

		Patella & Tibia	Protarsi & Tarsi
First pair of legs ¹	... 34 mm.	10 mm.	14 mm.
Second pair of legs	... 29 mm.	9 mm.	11 mm.
Third pair of legs	... 19 mm.	6 mm.	7 mm.
Fourth pair of legs	... 28 mm.	8 mm.	11 mm.
Thickness of femur about 2 mm.			

Abdomen long oval brownish variegated with orange lines on sides and dots below. Spinnerets form a normal rosette below at the hind end of the abdomen. Mandibles stout and black. Carapace somewhat convex and reddish brown in colour. Median eyes whitish forming a normal quadrangle and laterals black and contiguous. Sternum V-shaped and yellow. Clypeus proximally yellowish and distally blackish. Legs: femur and tibia yellowish, pro-tarsi and tarsi thin and long distally blackish covered with fine hairs, joints striped black and brown.

It is obvious from all the above characteristics that the specimen generally agrees with the description of *Nephila malabarensis* Walck.

The interest of the specimen lies in the fact that it is for the first time that I have come across this species in Bombay.

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July 16, 1953.

18. NOTES AND QUERIES ON LAND LEECHES

The two notes published in Vol. 50, No. 2 of the *Journal* suggest that a general article by an expert on the biology and habits of land leeches would interest many members of the Society; it is difficult for the laymen to find the answer to queries such as these:—

1. How many species of land leech are known to science?
2. Land leeches are unknown from Africa and the Americas: true or false?
3. Where do they go in the winter time?

In the tropics they are active all the year round; but in a monsoon climate they disappear entirely for about six months, during the cold dry winter. Do they get through this period in the form of eggs? or by burrowing into the soil? How do they survive the snow and frost at the upper limit of their range.

4. What is the normal food of a leech?
Humus? Soil?
5. What is the significance of a blood meal to a leech?

¹ About 4 times as long as the carapace—a feature of *N. malabarensis*.

The vast majority of leeches can never have the good fortune to secure a meal of blood all through their lives.

6. How high off the ground do leeches climb?

Has anyone ever recorded seeing a leech climbing the bole of a tree (as opposed to tall grass, herb, or low shrub)? For botanical purposes I have examined the boles of many trees recently in a Borneo forest of normal leech density, but have yet to see a leech climbing one.

7. What evidence is there to support the idea that leeches may at times drop onto hosts from overhanging vegetation?

In travel books one frequently comes across bald statements that 'leeches dropped on us from the trees'. If the writer were to say: 'While walking behind my companion 'X' I counted 23 leeches take a free drop at him, of which 15 landed on his head and shoulders but 7 scored near misses behind', or 'Every now and then there was a soft plop as a leech took a free drop at one of us, but miscalculated the range and hit the path' the circumstantial detail would carry conviction. The mere finding of a leech on one's neck is no evidence that it dropped from above—it is much more likely to have climbed from below.

Dr. Brooke Worth states that this dropping theory 'can be imagined' but points out some of the difficulties. It should be possible to test it experimentally, by placing large numbers of leeches on an overhead branch and then walking up and down underneath. I can only say that I have been looking for the flying leech for 20 years, in Kumaon, Nepal, various parts of Burma, and in Borneo, without having the good fortune to find one of these air-borne divisions.

8. How far off can a leech sense its host?

This again could be determined by experiment. Dr. Brooke Worth states that it cannot be assessed whether a leech's search is merely on a tactile basis, or an actual olfactory experience. If it is not olfactory, how is it that a leech, from a distance of 2 or 3 yards, will advance in a direct line towards a man standing perfectly still, and if the man takes a pace to the right or left, the leech will change the direction of its advance accordingly?

Travellers' tales suggest that if a man were to lie down and sleep in the forest without taking any precautions he might be sucked dry by leeches. This would obviously depend on the radius of the circle of attraction, and on whether leeches (like ants) can summon their brethren from ever increasing distances (this seems unlikely).

* * * * *

The following random notes may be of interest; I cannot claim to have studied leeches, except in so far as they forced themselves on my attention.

Ecology of Land Leeches.

In South-east Asia land leeches seem to be confined to the following forest types:—

<i>Champion Classification</i>	<i>Richards Classification</i> ¹
1. Tropical wet evergreen	Tropical rain forest
2. Tropical semi-evergreen	do.
3. Sub-tropical wet evergreen	Sub-tropical rain forest
4. Wet temperate	Montane rain forest
5. Moist temperate	? ?

Leeches are further confined to primary forest in the above types, or areas where the primary forest has been cleared *without the use of fire*. In secondary seres following shifting cultivation leeches (in my experience) are not found; there are several possible explanations:—

(a) the intense fire wipes out the entire leech population,

(b) or the intense insolation (solar radiation) to which the soil is subject after the fire and before the vegetation and the rice crop again affords soil cover, eliminates the humus and the leeches with it.

If a secondary sere were left undisturbed it would eventually (after several centuries) revert to primary forest, and presumably at some time in the succession the area would be re-colonised by leeches from neighbouring forest.

Leeches are not found in certain edaphic climax types of tropical rain forest; these are:—

Mangrove forests. The daily or periodic flooding of these forests with sea water is presumably lethal to leeches.

Peat-swamp forests. These cover some 6,000 sq. miles in the coastal areas of Sarawak and Brunei, and are also found in other parts of Malaysia. The forests grow on a considerable thickness of peat (average 20-25 ft.) and is well above reach of the highest tides; the surface water is fresh, but acid and the colour of strong tea. Superficially these areas would appear to be a paradise for leeches, but they are extremely rare; possibly the acidity of the water does not suit them.

The oak-chestnut forests of the Shan Plateau (Maymyo), which apparently fall in Champion's sub-tropical wet evergreen type, are free of leeches; perhaps the rainfall (50-60 inches per year) is insufficient.

The principal teak forests in Burma are found in the tropical moist deciduous type; a low ground fire burns through these forests every year, in February or March, and this must account for the absence of leeches. It is only where this type of forest merges with the tropical semi-evergreen, and is too wet to burn, that leeches appear.

¹ For the Richards Classification see 'The Tropical Rain Forest' by P. W. Richards.

One may deduce therefore that land leeches require :—

- (a) Sufficient precipitation to produce a more or less permanently moist humus layer for 5 to 6 months of the year.
- (b) Complete freedom from fire.
- (c) Complete freedom from salt-water flooding.
- (d) Surface water that is not too acid.

A special type of secondary sere in the wet and moist temperate forests which leeches seem to favour, and which should therefore be mentioned, is the grassy grazing ground near villages; possibly the leeches are brought in from surrounding forest by men or animals and find the micro-climate of these grasslands to their liking.

It may be that different species of leeches have different habitat preferences; whether anyone has studied this question I cannot say.

Danger from leech-bites.

The usual experience seems to be that, provided normal precautions are taken, leech bites are no more liable to go septic than any other wound; but if the resistance of the host has been lowered, e.g. by malnutrition, then sepsis is common; thus Mr. Spencer Chapman records in 'The Jungle is Neutral' that initially leech bites healed normally, but after some months in the jungle on inadequate rations they started to go septic.

What does a traveller do if a leech disappears into one of the 'intimate orifices of the body'? I once experienced the entry of a leech into the rectum; there was no pain or irritation, but some bleeding after a quarter of an hour or so; as the incident occurred in the mountains some days' march from medical aid, I awaited further developments with some trepidation, but nothing further happened; I only hope the leech found his way out again in due course.

I was recently laid up for a week by a specimen of 'Larva migrans' (see Manson-Bahr's Tropical Diseases) which secured entry into the leg through a leech bite; this however is a rare complication.

Leech repellents.

It does not seem to be generally known that *two* pairs of socks or stockings will almost invariably defeat a leech; in the absence of chemical repellents I have found this defence, combined with long trousers, boots, and ankle puttees, entirely effective, provided that one can halt every half-mile or so to remove leeches climbing up towards the waist, having been defeated lower down. The trousers should be extra long in the leg, like the trousers that are used for ski-ing, so that they do not pull too high up the leg.

There is a choice of several chemical repellents. Mrs. Bor ('Adventures of a Botanist's Wife') has a favourite recipe:—

'In every account I have ever read of jungle travel the writers describe their leech troubles and their ways of dealing with them, yet never have I met or read of anyone who seemed to know the only way (as we discovered) of defeating leeches. People recommend the use of tobacco leaves stuffed inside socks and shoes, or

the use of little bags of salt tied to a walking stick, or the application of a solution of areca-nut to socks or shoes. We tested all these and found them inadequate, not to say useless.

Early in our wanderings my husband devised the only efficient preventative we have ever known. It was obvious that tobacco leaves, apart from being uncomfortable, were inadequate because the leeches could make their way in between the leaves. So we tried soaking tobacco leaves overnight in boiling water. By next morning this had produced a strong kind of tea which we poured over our socks and shoes, allowing it to soak in. We also applied it like paint to the porters' bare feet and ankles, and to the dogs' feet and ears Nicotine is deadly poison to leeches, and though they still came looping towards us across the sodden track and dropping on us from the trees and undergrowth, they shrivelled up and died at their first contact with tobacco-soaked skin or cloth.'

The difficulty is to find a repellent that retains its potency even after repeatedly wading streams. Mrs. Bor goes on to say:—

'Even four hours' marching through torrential rain could not wash off the tobacco tea. Only once did it fail us; that was when we had to ford a river twenty-five times on a six-hour journey.'

Di-methyl-phthalate was extensively used by the U.S. Army in the last war as a general insect repellent; its effects do not seem to last more than 2-3 hours, even without wading streams, so one should carry a bottle in one's pocket and apply it periodically. 'Nature' in 1952 reported experiments being conducted by the U.S. Army with a new dope, specially designed for leeches, which was said to last for days; further news of this product will be awaited with interest.

I have found a mixture of citronella oil and vaseline to be effective—the vaseline prevents the oil being washed out too easily. A mixture of Di-methyl-phthalate and vaseline might be worth a trial.

They say that when in Rome one should do as the Romans do. The Dayak method is to wear nothing but a loin cloth, chew betel methodically, and aim a well-directed stream of betel juice at any leech that secures a footing; one reason why this example is not followed by Europeans is that (according to Mr. Spencer Chapman) it takes about three months to harden one's feet sufficiently to go bare-foot in tropical forest. Natives seem to become curiously indifferent to leeches. I remember seeing a Sherpa youth come down from the forests above Tarke Gyang in Nepal, where he had been collecting firewood; he arrived back in the village with a cluster of leeches about the size of a golf-ball on top of his right foot—he just wasn't interested in removing them.

FOREST OFFICE,
BRUNEI,
(VIA SINGAPORE),
August 5, 1953.

B. E. SMYTHIES